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RELATIVE ABUNDANCE OF PLANKTON OFF NAPLES, FLORIDA, AND ASSOCIATED HYDROGRAPHIC DATA, 1956-57

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RELATIVE ABUNDANCE OF PLANKTON OFF NAPLES, FLORIDA, AND ASSOCIATED HYDROGRAPHIC DATA, 1956-57

by

Alexander Dragovich

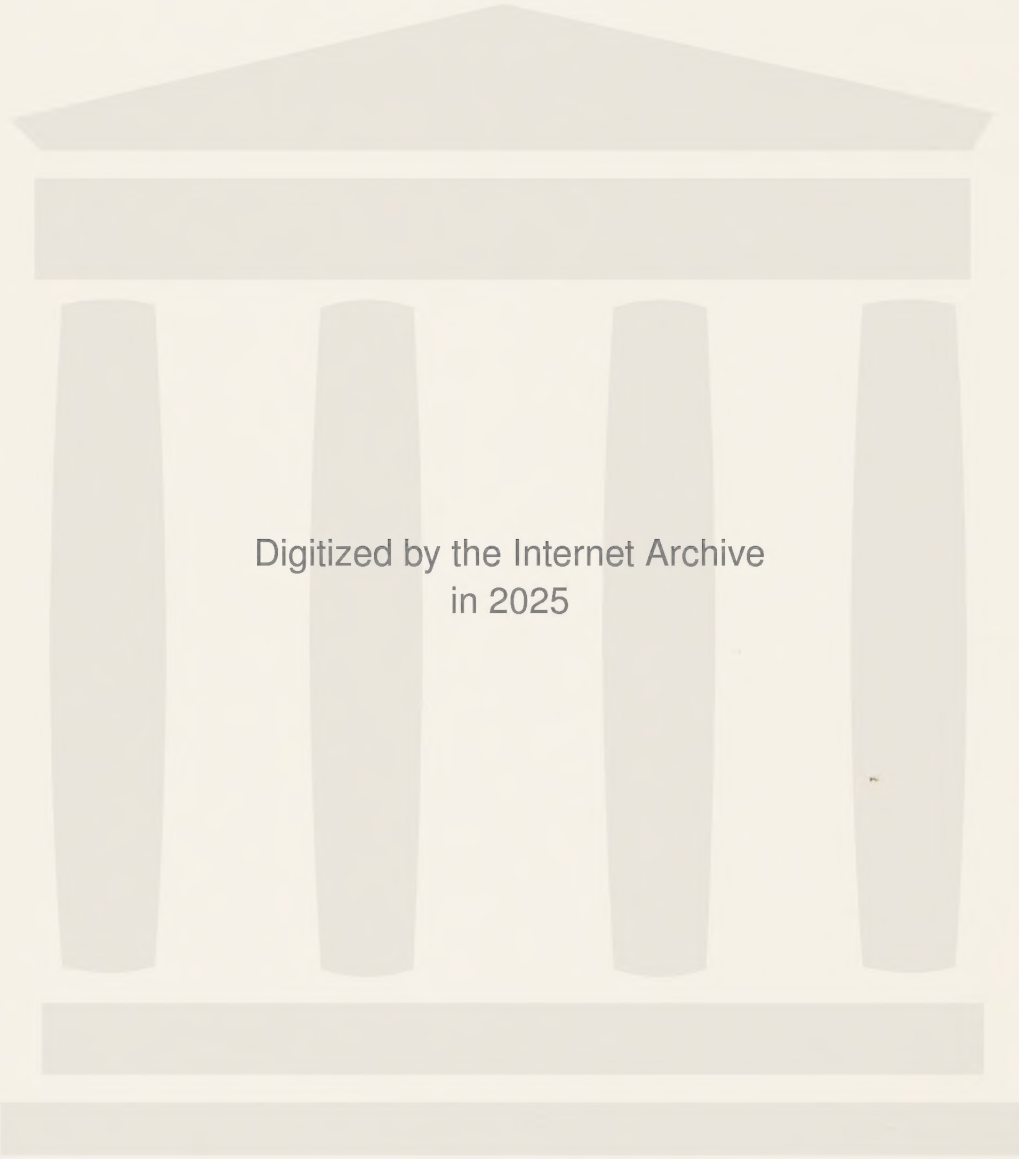


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RELATIVE ABUNDANCE OF PLANKTON OFF NAPLES, FLORIDA, AND ASSOCIATED HYDROGRAPHIC DATA, 1956-57

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ABSTRACT

Some chemical, physical, and plankton characteristics of the surface waters at Naples, Florida, have been investigated. Concentrations of inorganic phosphate, total phosphate, nitrate-nitrite nitrogen, carbohydrate, and protein were determined over a period of 17 months. Water temperatures, salinities, occurrence, and composition of phytoplankton and zooplankton were also recorded.

INTRODUCTION

This study adds to the hydrographic and biological data available for the Florida red tide area. It is the fifth report by the U. S. Bureau of Commercial Fisheries on field studies of the Florida red tide. The first four reports were by Graham, Amison, and Marvin (1954), Marvin (1955a), Finucane and Dragovich (1959), and Dragovich, Finucane, and May (1961). Other studies on planktonic forms of the Florida west coast have been made by King (1950), Davis (1948 and 1950), Davis and Williams (1950), and Gunter *et al.* (1948).

Knowledge of the species composition and relative abundance of planktonic forms, together with associated physical and chemical parameters, is important in characterizing a marine environment (Cleve, 1900, and Russell, 1939). Previous plankton analyses for the Florida red tide area provide comparatively little informa-

tion regarding coincident aquatic conditions. In this report values for salinity, temperature, inorganic phosphorus, total phosphorus, nitrate-nitrite nitrogen, carbohydrate, and protein are given with abundance estimates of 48 taxa of phytoplankton and 13 zooplankton taxa. These data cover the coastal waters off Naples, Florida, for the period March 1956 to August 1957.

MATERIALS AND METHODS

Surface samples of water were collected from Naples Pier at Naples, Florida (lat. 26°07.9'N., long. 81°48.5'W. Fig. 1). The mean low water depth at the pier was 5 feet with a mean tidal range of 2.1 feet. Three or four times a month water samples were taken with 2-liter Erlenmeyer flasks for chemical analysis. Immediately after collection the samples were transferred to 200 mm. pyrex culture vials, capped with solid polyethylene screw caps, and sealed with plastic electrician's tape. They were tested

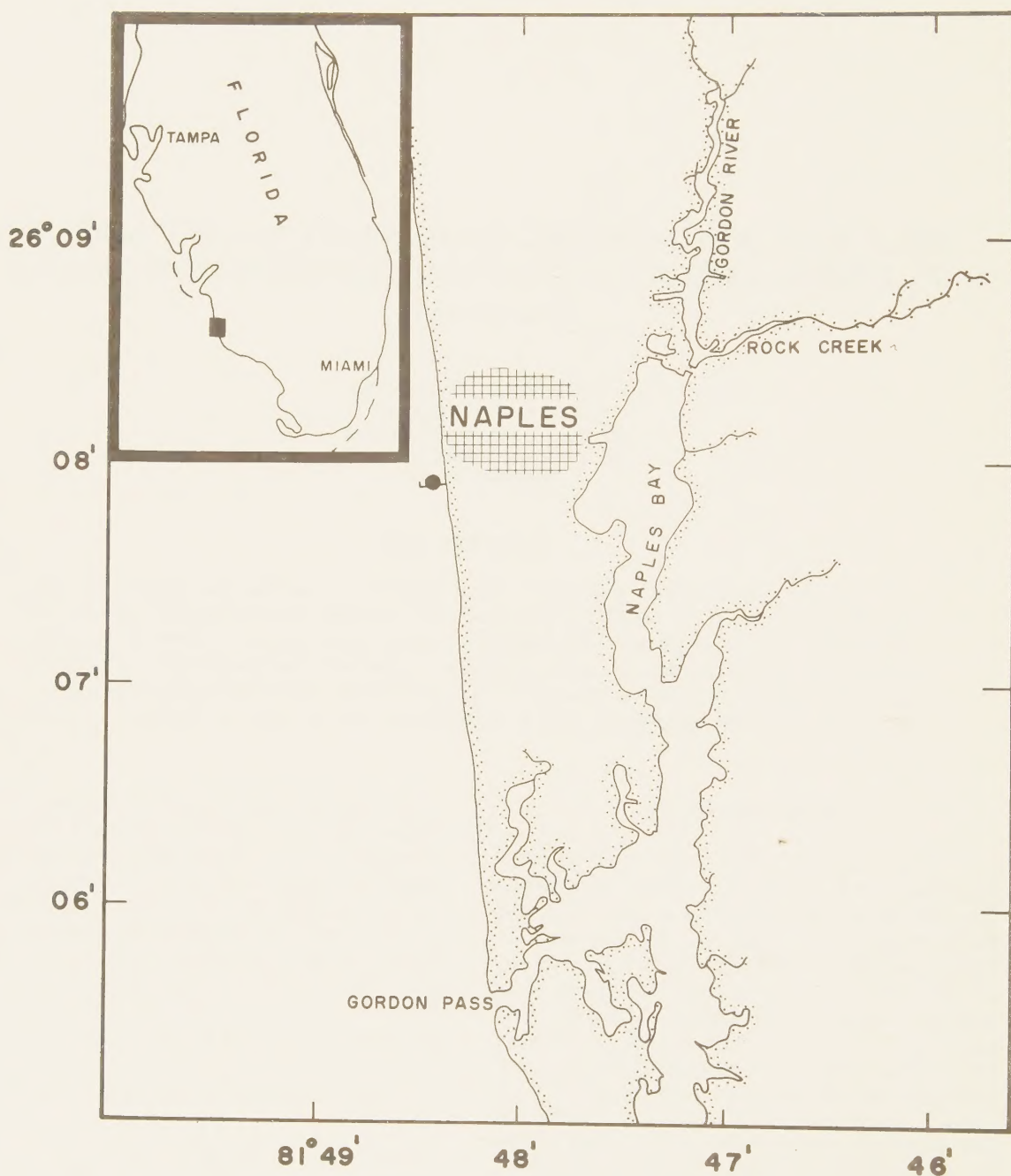


Figure 1.--Map of Naples area indicating station location. (The area included in this map is indicated as a black rectangle on the inset.)

for total and inorganic phosphorus, nitrate-nitrite nitrogen, carbohydrate, and protein.

Temperature, salinity, and plankton determinations were usually made 5 times a week. The particular col-

lection method employed was chosen to permit detection of delicate or minute organisms which would have been fragmented or destroyed if collected with a plankton net. Water samples to be analyzed for plankton were collected like the chemical samples, in

2-liter Erlenmeyer flasks previously rinsed with a portion of sample water, and examined within 24 hours after collection.

The counting technique for *Gymnodinium breve* and preparation of the samples for the estimation of relative abundance of other organisms were those described by Finucane and Dragovich (1959). Abundance estimates of microorganisms other than *G. breve* were made as follows: three 1-ml. portions of the sample were pipetted from just beneath the surface of the water and placed on a 3-depression slide. After microscopic examination of the three aliquots, the abundance of phytoplankton forms was recorded in terms of three categories: + = 1-24 cells per ml.; ++ = 25-99 cells per ml.; and +++ = 100 or more cells per ml. The same procedure was employed for zooplankton estimates, using these categories: x = 1-9 organisms per ml.; xx = 10-49 organisms per ml.; and xxx = 50-100 organisms per ml.

The following physical and chemical methods were employed:

Water temperature: determined with mercury thermometer calibrated to the nearest 10th of a degree centigrade.

Salinity: determined by Mohr-Knudsen method (Knudsen, 1901).

Nitrate-nitrite nitrogen: determined by the method of Zwicker and Robinson (1944) as modified by Marvin (1955b).

Inorganic phosphorus: determined according to the Robinson and Thompson (1948) method.

Total phosphorus: determined by the method of Harvey (1948).

Carbohydrates: determined by the method of Erdman and Little (1950) as modified by Zein-Eldin and May (1958).

Protein: determined by the method of Wangersky (Collier, 1958) as modified by Marvin et al., 1960.

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APPENDIX TABLES

EXPLANATION OF COLUMN HEADINGS AND SYMBOLS

Time	Eastern Standard Time	<u>Symbols for phytoplankton abundance:</u>
NO ₃ -NO ₂	Nitrate-nitrite nitrogen, μg. at./l.	+ 1-24 cells per ml.
PO ₄ -P	Phosphate phosphorus, μg.at./l.	++ 25-99 cells per ml.
In.	Inorganic	+++ 100 or more cells per ml.
Tot.	Total	<u>Symbols for zooplankton abundance:</u>
Carbohydrate	Arabinose equivalents, mg./l.	x 1-9 organisms per ml.
Protein	Tyrosine equivalents, mg./l.	xx 10-49 organisms per ml.
		xxx 50-100 organisms per ml.

Table 1.--Relative abundance of plankton with associated hydrographic data

M A R C H 1956

Day	1	2	5	6	7	8	9	12	13	14	15	16	19	20	21	22	23	26	27	28	29	30
Time	0910	0910	0908	1000	1030	0840	0900	0905	0843	0905	1615	1540	1615	1154	1050	1500	1000	0918	0940	1050	1020	0900
BIOLOGICAL DATA																						
Unicellular plankton																						
Amphidinium spp.																						
Cochlodinium spp.													+					+				
Gymnodinium breve																						
G. simplex																						
G. splendens																						
G. spp.					+			+		+	+	+		+	++	+	+	++		+	+	
Gyrodinium spirale																						
G. spp.			+	+				+				+	+	+								
Torodinium spp.																						
Polykrikos spp.																						
Nematodinium spp.																						
Pouchetia spp.																						
Oxyrrhis spp.						+																
Ceratium furca			+									+				+						
C. fusus																						
C. tripos																						
Gonyaulax spp.																						
Peridiniopsis spp.		+					+															
Peridinium depressum																						
P. digitale															+							
P. divergens																						
P. spp.									+													
Dinophysis tripos																						
D. spp.																						
Exuviella spp.																						
Prorocentrum sp.																						
Silicoflagellidae																						
Euglena spp.																						
Peranema spp.																						
Melosira spp.	+				+	++	+	++	++	+	+	++	+	+	+	+						
Skeletonema spp.																						
Chaetoceros spp.																						
Guinardia spp.																						
Rhizosolenia spp.																						
Thalassiothrix spp.																						
Navicula spp.																						
Pleurosigma spp.																						
Nitzschia spp.										+		+										

Table 1. cont'd

Day Time	1 0910	2 0910	5 0908	6 1000	7 1030	8 0840	9 0900	12 0905	13 0843	14 0905	15 1615	16 1540	19 1615	20 1154	21 1050	22 1500	23 1000	26 0918	27 0940	28 1050	29 1020	30 0900
BIOLOGICAL DATA																						
Unicellular plankton																						
Grammatophora spp.																						
Unidentified phytoplankton	++	++	++	++	++	+	++	+		++	++		++	++		++	++		++	++	++	++
Strombidium sp.																						
Unidentified Halteriidae												++										
Tintinnopsis spp.																						
Unidentified Tintinnidae																						
Vorticella spp.				+						+						+	+	+		+	+	
Cothurnia sp.																						
Pleuronema sp.																						
Unidentified ciliates		++	+	+	+		+		+	+	+		+	++	+		++		+		+	
Multicellular plankton																						
Preales sp.																						
Synchaeta sp.																						
Unidentified Rotifera			x	x																		
Copepoda																						
Ostracoda									x												x	
Chaetopoda																						
Coelenterata																						
Nauplii	x									x								x				
Megalops and Zoea										x			x		x						x	
Veliger																						
Trochophore																						
Echinoderm larvae																						
Pisces larvae				x																		
HYDROGRAPHIC DATA																						
Temperature, °C.	19.5	19.9	21.9	22.6	23.5	24.0	22.9	23.5	24.9	25.0	26.8	26.8	24.0	20.8	19.2	20.9	19.8	19.4	19.5	20.5	21.0	21.9
Salinity, ‰	36.3	36.3	36.2	36.3	36.3	36.4	36.4	36.3	36.6	36.4	36.6	37.0	36.8	37.0	37.1	37.0	37.1	37.0	36.2	36.9	36.8	36.8
NO ₃ -NO ₂																						
In. PO ₄ -P	1.5					0.5					0.2					3.2					0.3	
Tot. PO ₄ -P	2.9					1.0					0.2					3.5					0.7	
Carbohydrate	1.6					4.1					0.9					1.1					0.7	
Protein	3.2															1.0						

Table 2.--Relative abundance of plankton with associated hydrographic data

A P R I L 1956

Day	2	3	4	6	9	10	11	12	13	16	17	18	19	20	23	24	25	26	27	30
Time	1030	1050	0940	0955	0930	0920	0920	0930	0930	0955	0915	1030	0900	0855	0935	0830	0835	0900	0835	0910
BIOLOGICAL DATA																				
Unicellular plankton																				
Amphidinium spp.																				
Cochlodinium spp.																				
Gymnodinium breve																				
G. simplex																				
G. splendens																				
G. spp.	++	+		+	+	++		+			+	+	+	+			+			+
Gyrodinium spirale				+	+			+												
G. spp.	++	+	+	+	+	+		++	+	+	+	+		+						
Torodinium spp.																				
Polykrikos spp.																				
Nematodinium spp.																				
Pouchetia spp.				+																
Oxyrrhis spp.													+							
Ceratium furca	+					+				+										
C. fusus																				
C. tripos																				
Gonyaulax spp.																				
Peridiniopsis spp.					+	+														
Peridinium depressum																				
P. digitale																				
P. divergens				+	+	+		+	+											
P. spp.	+				+	+		+				+	+	+						
Dinophysis tripos																				
D. spp.																				
Exuviella spp.																				
Prorocentrum sp.																				
Silicoflagellidae																				
Euglena spp.																				
Peranema spp.																				
Melosira spp.	+	+	+	+				+	+	+	+						+			
Skeletonema spp.																				
Chaetoceros spp.	+			+	+															
Guinardia spp.																				
Rhizosolenia spp.																				
Thalassiothrix spp.																				
Navicula spp.																				
Pleurosigma spp.																				
Nitzschia spp.						+			+											

Table 2. cont'd

Day Time	2 1030	3 1050	4 0940	6 0955	9 0930	10 0920	11 0920	12 0930	13 0930	16 0955	17 0915	18 1030	19 0900	20 0855	23 0935	24 0830	25 0835	26 0900	27 0835	30 0910
BIOLOGICAL DATA																				
Unicellular plankton																				
Grammatophora spp.																				
Unidentified																				
phytoplankton	++	++	+	++	++	++	++	++	++	++	++	++	++	++	+	++	++	++	++	++
Strombidium sp.																				
Unidentified																				
Halteriidae																				
Tintinnopsis spp.	+				+	++														++
Unidentified																				
Tintinnidae																				
Vorticella spp.	+		+					++		+		+			++	+		+		+
Cothurnia sp.																				
Pleuronema sp.																				
Unidentified ciliates		+	+	+						+	+	+	+	+	+	+	+	+	+	+
Multicellular plankton																				
Protoles sp.																				
Synchaeta sp.																				
Unidentified Rotifera													x	x						
Copepoda																				
Ostracoda																				
Chaetopoda																				
Coelenterata																				
Nauplii																				
Megalops and Zoaea				x	x					x		x		x			x	x	x	
Veliger																				
Trochophore										x										
Echinoderm larvae																				
Pisces larvae				x																
HYDROGRAPHIC DATA																				
Temperature, °C.	22.0	22.0	22.9	24.6	23.6	22.3	21.9	19.9	20.8	22.5	22.9	23.6	22.2	21.5	22.5	23.0	23.8	23.9	24.6	25.0
Salinity, ‰	37.0	36.8	37.0	37.2	37.3	37.2	37.2	37.3	37.3	37.2	37.2	37.6	37.4	36.7	36.9	36.9	36.8	37.2	37.8	37.3
NO ₃ -NO ₂																				
In. PO ₄ -P				0.5				3.2					0.2					0.2		
Tot. PO ₄ -P				0.8				4.2					0.2							
Carbohydrate				0.3				1.2										0.8		
Protein				1.0				1.7					1.5					0.1		

Table 3.--Relative abundance of plankton with associated hydrographic data

M A Y 1956

Day	1	2	3	4	7	8	9	10	11	14	15	16	17	18	21	22	23	24	25	28	29	31
Time	0908	0830	1040	0845	0930	0950	1035	0920	0850	0900	0847	1025	0935	1000	0900	1055	0840	0830	0840	1000	0850	0850
BIOLOGICAL DATA																						
<u>Unicellular plankton</u>																						
Amphidinium spp.																						
Cochlodinium spp.	+																					
Gymnodinium breve																						
G. simplex																						
G. splendens					+								+		+							
G. spp.		+	+		+						+	+							+	+		+
Gyrodinium spirale																						
G. spp.	+	+	+			+	+		+		+	+	+	+	+					+	+	+
Torodinium spp.																						
Polykrikos spp.			+																			
Nematodinium spp.												+										
Pouchetia spp.																						
Oxyrrhis spp.																						
Ceratium furca																		+				
C. fusus																						
C. tripos																						
Conyaulax spp.																						
Peridiniopsis spp.					+					+					+			+				+
Peridinium depressum										+												
P. digitale																						
P. divergens																						+
P. spp.	+				+						+				+							
Dinophysis tripos																						
D. spp.																						
Exuviella spp.																						
Prorocentrum sp.																						+
Silicoflagellidae																						
Euglena spp.																						
Peranema spp.																						
Melosira spp.					+													++			+	
Skeletonema spp.					+	+							+	+	++	+			+		+	
Chaetoceros spp.	+												+	+								
Guinardia spp.																						
Rhizosolenia spp.																						
Thalassiothrix spp.																						
Navicula spp.											+											
Pleurosigma spp.																						
Nitzschia spp.		+									+										+	

Table 3. cont'd

Day	1	2	3	4	7	8	9	10	11	14	15	16	17	18	21	22	23	24	25	28	29	31
Time	0908	0830	1040	0845	0930	0950	1035	0920	0850	0900	0847	1025	0935	1000	0900	1055	0840	0830	1000	0850	0850	
BIOLOGICAL DATA																						
Unicellular plankton																						
Gramatophora spp.																						
Unidentified phytoplankton																						
Strombidium sp.	++	++	++		++	++	+	++	++	++	++	+	++	++	++	++	++	++	++	++	++	++
Unidentified Halteriidae																						
Tintinnopsis spp.										++												
Unidentified Tintinnidae																		+				
Vorticella spp.								+											+	+		
Cothurnia sp.	+									+												
Pleuronema sp.									+													
Unidentified ciliates	+	+			+	+	+	+	+		+	+	+	+	++	+	+	+	++	+	+	+
Multicellular plankton																						
Proales sp.																						
Synchaeta sp.																						
Unidentified Rotifera																						
Copepoda																						
Ostracoda																						x
Chaetopoda																						
Coelenterata																						
Nauplii		x																xx			x	
Megalops and Zoea								x														
Veliger																						
Trochophore																						
Echinoderm larvae																						
Pisces larvae			x																			
HYDROGRAPHIC DATA																						
Temperature, °C.	24.9	24.9	25.9	26.3	27.7	27.5	27.7	27.0	27.4	28.0	28.2	28.5	27.5	27.7	27.0	29.5	27.0	27.5	28.2	27.5	26.9	26.5
Salinity, ‰	36.3	36.3	37.1	37.1	37.8	37.8	37.8	37.7	37.7	37.6	36.9	36.8	36.6	36.6	36.8	37.0	37.1	37.0	37.0	37.0	37.1	36.2
NO ₃ -NO ₂			0.3					0.3					0.4					1.8				0.4
In. PO ₄ -P			0.0					0.2					0.7					0.3				0.1
Tot. PO ₄ -P			0.9					0.6					0.6					0.6				0.4
Carbohydrate			1.7					2.6					1.6					1.6				
Protein			0.1					0.0					0.0									0.0

Table 4.--Relative abundance of plankton with associated hydrographic data

J U N E 1956

Day	1	4	5	6	7	8	11	12	13	14	15	18	19	20	21	22	25	26	27	28	29
Time	0850	1055	0900	1250	1033	1010	0940	0900	0840	0850	1005	1040	0900	0930	0930	0845	0910	0840	0845	0845	0830
BIOLOGICAL DATA																					
Unicellular plankton																					
Amphidinium spp.																					
Cochlodinium spp.																					
Gymnodinium breve																					
G. simplex																					
G. splendens																					
G. spp.	+	+							+	+	+	+	+	+	++	+	++	+	+	++	+
Gyrodinium spirale																					
G. spp.	+		+				+	+	+	+	+	+			+		++	++	+	+	+
Torodinium spp.							+														
Polykrikos spp.																					
Nematodinium spp.																					
Pouchetia spp.																					
Oxyrhis spp.																					
Ceratium furca									+												
C. fusus									+												
C. tripos																					
Gonyaulax spp.																					
Peridiniopsis spp.															+		+		+		
Peridinium depressum																					
P. digitale																					
P. divergens									++		+	++	+	+	+		+		+		
P. spp.				+			++										+				
Dinophysis tripos																					
D. spp.																					
Exuviella spp.																		+			
Prorocentrum sp.				+		+		+													
Silicoflagellidae																					
Euglena spp.																					
Peranema spp.																					
Melosira spp.					+		++		+		+	+	+				+				
Skeletonema spp.																					
Chaetoceros spp.	+	+	+	++	++	++	+	+	+	++	+	+	+	+	+	++	+	+	+	+	++
Guinardia spp.	+			+	+	+			+												
Rhizosolenia spp.																					
Thalassiothrix spp.								+													
Navicula spp.																					
Pleurosigma spp.																					
Nitzschia spp.	+						+				++		+			++	+	+			

Table 4. cont'd

Day	1	4	5	6	7	8	11	12	13	14	15	18	19	20	21	22	25	26	27	28	29
Time	0850	1055	0900	1250	1033	1010	0940	0900	0840	0850	1005	1040	0900	0930	0930	0845	0910	0840	0845	0845	0830
BIOLOGICAL DATA																					
Unicellular plankton																					
Grammatophora spp.																					
Unidentified phytoplankton	++	++	++	++	++	++	++	++	+	++	++		++	++		++		++	++	++	++
Strombidium sp.																					
Unidentified Halteridae																					
Tintinnopsis spp.																					
Unidentified Tintinnidae																					
Vorticella spp.																					
Cothurnia sp.																					
Pleuroema sp.																					
Unidentified ciliates	+	+	+		+	+	+	+	+	+	+	+	+	+			++	+	++		+
Multicellular plankton																					
Proales sp.																					
Synchaeta sp.																					
Unidentified Rotifera																					
Copepoda																					
Ostracoda																					
Chaetopoda																					
Coelenterata																					
Nauplii		x								x											
Megalops and Zoea																					
Veliger																					
Trochophore																					
Echinoderm larvae																					
Pisces larvae																					
HYDROGRAPHIC DATA																					
Temperature, °C.	27.8	28.5	28.8	29.8	28.6	28.5	27.8	27.5	27.2	27.0	22.0	27.9	28.8	29.0	28.8	29.1	29.3	29.4	29.0	29.5	29.0
Salinity, ‰	37.0	37.2	37.5	37.4	37.6	37.7	37.4	37.6	37.6	37.6	37.6	37.5	37.5	37.7	37.7	37.6	37.9	38.0	38.0	38.2	38.0
NO ₃ -NO ₂					0.4					1.5					0.4					9.3	
In. PO ₄ -P					0.6					0.2					0.3					1.0	
Tot. PO ₄ -P					1.0					1.1					1.3					1.1	
Carbohydrate					1.6					1.7					1.7					1.1	
Protein					0.5					0.4					0.4					0.0	

Table 5.--Relative abundance of plankton with associated hydrographic data

J U L Y 1956

Day	2	3	5	6	9	10	11	12	13	16	17	18	19	20	23	24	25	26	27	30	31
Time	0910	0950	0830	0825	0850	0950	0925	0900	0935	0915	0915	0830	0845	0915	0900	0830	0845	0840	0830	0930	0830
BIOLOGICAL DATA																					
Unicellular plankton																					
Amphidinium spp.																					
Cochlodinium spp.																					
Gymnodinium breve																					
G. simplex																					
G. splendens										+											
G. spp.	+	+	+	+	+		+	++		+	+	+	+	+	+	+	+	+	+	+	+
Gyrodinium spirale																					
G. spp.			+		+		+														
Torodinium spp.										+											
Polykrikos spp.																					
Nematodinium spp.												+									
Pouchetia spp.																					
Oxyrrhis spp.																					
Ceratium furca																					
C. fusus																					
C. tripos																					
Gonyaulax spp.																					
Peridiniopsis spp.														+							
Peridinium depressum																					
P. digitale																					
P. divergens																					
P. spp.	+	+	+		+		+			+			+	+			+	+	+	+	+
Dinophysis tripos																					
D. spp.																					
Exuviella spp.																					
Prorocentrum sp.		+																			
Silicoflagellidae											+										+
Euglena spp.																					
Peranema spp.																					
Melosira spp.	+				+							+					+	+	+	+	+
Skeletonema spp.																					
Chaetoceros spp.			+	+	+		+	+													
Guinardia spp.				+																	
Rhizosolenia spp.					+																
Thalassiothrix spp.										+											
Navicula spp.																					
Pleurosigma spp.																					
Nitzschia spp.			+	+	+		+														
Grammatophora spp.																					

Table 5. cont'd

Day	2	3	5	6	9	10	11	12	13	16	17	18	19	20	23	24	25	26	27	30	31
Time	0910	0950	0830	0825	0850	0950	0925	0900	0935	0915	0915	0830	0845	0915	0900	0830	0845	0840	0830	0930	0830
BIOLOGICAL DATA																					
Unicellular plankton																					
Unidentified phytoplankton	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++
Strombidium sp.																					
Unidentified Halteriidæ																					
Tintinnopsis spp.																					
Unidentified Tintinnidæ																					
Vorticella spp.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Cothurnia sp.																					
Pleuronema sp.																					
Unidentified ciliates																					
Multicellular plankton																					
Proales sp.																					
Synchaeta sp.																					
Unidentified Rotifera																					
Copepoda																					
Chaetopoda																					
Coelenterata	x	x																			
Nauplii		x																			
Megalops and Zoea																					
Veliger																					
Trochophore																					
Echinoderm larvae																					
Pisces larvae																					
HYDROGRAPHIC DATA																					
Temperature, °C.	28.9	29.4	28.5	28.0	29.5	28.8	29.7	29.8	30.1	30.0	31.0	30.4	31.0	31.0	30.5	29.9	30.0	30.0	30.2	30.0	
Salinity, ‰	38.0	38.0	37.8	37.7	37.7	37.8	37.8	38.0	38.0	38.0	38.0	38.2	38.2	38.3	38.1	38.2	38.4	38.1	38.0	38.1	
NO ₃ -NO ₂			0.2					0.3					0.0					0.0			
In. PO ₄ -P			0.6					0.3					1.2					0.3			
Tot. PO ₄ -P			0.6					0.4										1.0			
Carbohydrate			1.1					2.1					0.9					0.6			
Protein			0.1					0.0					0.0					0.1			

Table 6.--Relative abundance of plankton with associated hydrographic data

AUGUST 1956

Day Time	1 0830	2 0840	3 0820	6 0945	7 0830	8 0845	9 0845	10 0830	13 0915	14 0840	15 0930	16 0845	17 0830	20 0900	21 0900	22 0905	23 0845	24 1120	27 0845	28 0840	29 0900	30 0855	31 1000	
BIOLOGICAL DATA																								
Unicellular plankton																								
Amphidinium spp																								
Cochlodinium spp.																								
Gymnodinium breve																								
G. simplex																								
G. splendens		+																						
G. spp.	+	+	+	+	+	+	+++	+++	+++	+++	+	+		+	+	+	+	+	+	+	+	+	+	
Gyrodinium spirale																								
G. spp.																								
Torodinium spp.		+	+	+	+	+	+	+	+	+														
Polykrikos spp.																								
Nematodinium spp.																								
Pouchetia spp.																								
Oxyrrhis spp.																								
Ceratium furca																								
C. fusus									+					+									+	
C. tripos																								
Gonyaulax spp.																								
Peridiniopsis spp.	+	+			+		+	+																
Peridinium depressum																		+						
P. digitale																								
P. divergens				+																				
P. spp.	+	+	+	+	+									+	+		+	+	+		+	+		
Dinophysis tripos																								
D. spp.																								
Exuviella spp.		+																						
Prorocentrum sp.																								
Silicoflagellidae														+										
Euglena spp.																								
Peranema spp.																								
Melosira spp.	+		+	+				+						+	+		+	+	+	+	+	+	+	
Skeletonema spp.																								
Chaetoceros spp.	+	+	+	+							+			+	+	+	+	+	+	+	+	+	+	
Guinardia spp.																								
Rhizosolenia spp.																								
Thalassiothrix spp.																		+					++	
Navicula spp.																								
Pleurosigma spp.																								
Nitzschia spp.							+														++	++	+	

Table 6. cont'd

Day Time	1 0830	2 0840	3 0820	6 0945	7 0830	8 0845	9 0845	10 0830	13 0915	14 0840	15 0930	16 0845	17 0830	20 0900	21 0900	22 0905	23 0845	24 1120	27 0845	28 0840	29 0900	30 0855	31 1000	
BIOLOGICAL DATA																								
Unicellular plankton																								
Grammatophora spp.																								
Unidentified phytoplankton	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++			+	++	++	
Strombidium sp.																								
Unidentified halteriidae																								
Tintinnopsis spp.	+	+				+				+				+	+		+	+			+		+	
Unidentified Tintinnidae																								
Vorticella spp.	+	+		+					+	+				+			+		+					
Cothurnia sp.																								
Pleuronema sp.																								
Unidentified ciliates	+	+	+	+	+			+			+	+	+	+	+	+	+	+	+	+	+	+	+	
Multicellular plankton																								
Proales sp.																								
Synchaeta sp.																								
Unidentified Rotifera	x																						x	
Copepoda		x															x	x				x	x	
Ostracoda											x												x	
Chaetopoda																								
Coelenterata																								
Nauplii				x	xx																			
Megalops and Zoea		x			xx			x						x										
Veliger		x	x		xx																			
Trochophore																								
Echinoderm larvae																		x						
Pisces larvae					x																			
HYDROGRAPHIC DATA																								
Temperature, °C.	30.0	31.0	30.1	31.9	31.2	31.0	31.1	31.0	30.8	31.0	31.0	31.0	31.0	31.0	31.0	30.0	29.0	31.2	30.5	30.7	30.4	31.7	31.7	
Salinity, ‰	37.9	38.1	38.1	38.2	38.4	38.2	38.1	38.2	38.2	38.1	38.3	38.0	38.0	38.0	38.0	38.2	37.7	37.6	37.8	37.9	38.2	38.1	37.1	
NO ₃ -NO ₂		0.6					0.0					0.4					1.2						0.9	
In. PO ₄ -P		0.3															0.7						0.2	
Tot. PO ₄ -P		1.0					1.0					0.2					0.9						1.3	
Carbohydrate		1.4					1.0					1.0					0.9						1.5	
Protein		0.2					0.3					0.3					0.3						0.1	

Table 7.--Relative abundance of plankton with associated hydrographic data

S E P T E M B E R 1956

Day	4	5	6	7	10	11	12	13	14	17	18	19	20	21	24	25	26	27	28
Time	0920	0845	0855	0842	0830	0855	0830	0830	0900	0832	0835	0845	0830	0830	0845	0830	0830	0830	0830
BIOLOGICAL DATA																			
Unicellular plankton																			
Amphidinium spp.																			
Cochlodinium spp.																			
Gymnodinium breve																			
G. simplex																			
G. splendens																			
G. spp.	+	+	++		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Gyrodinium spirale																			
G. spp.	+		+																
Torodinium spp.																			
Polykrinos spp.																			
Nematodinium spp.																			
Pouchetia spp.																			
Oxvithis spp.																			
Ceratium furca																			
C. fusus														+					
C. tripos																			
Conyaulax spp.																			
Peridiniopsis spp.																			
Peridinium depressum																			
P. digitale																			
P. divergens		+																	
P. spp.	+				+++			+		+					+				
Dinophysis tripos																			
D. spp.																			
Exuviella spp.																			
Prorocentrum sp.																			
Silicoflagellidae																+			
Euglena spp.																			
Peranema spp.																			
Melosira spp.	+	++	+			+					+				+		+		+
Skeletonema spp.																			
Chaetoceros spp.		+				+					++					+		+	+
Guinardia spp.																			
Rhizosolenia spp.			++	++															
Thalassiothrix spp.																			
Navicula spp.		+																	
Pleurosigma spp.																			
Mitschia spp.			+	++															

Table 7. cont'd

Day	4	5	6	7	10	11	12	13	14	17	18	19	20	21	24	25	26	27	28
Time	0920	0845	0855	0842	0830	0855	0830	0830	0900	0900	0832	0835	0845	0830	0845	0830	0830	0830	0830
BIOLOGICAL DATA																			
Unicellular plankton																			
Grammatophora spp.																			
Unidentified																			
phytoplankton	++	++	++	++	+	++	++	++	++	++	++	++	++	++	++	+	++	++	++
Strombidium sp.															+				
Unidentified																			
Halteridae					+	+	+	+							+			+	
Tintinnopsis spp.			+										+						
Unidentified																			
Tintinnidae																			
Vorticella spp.	++	++	+		+		+	+	+	+	+				+		+		
Gothurnia sp.																			
Pleuronema sp.																			
Unidentified ciliates	++	++		+		+	+	+	+	++	+	++	+	+	+	++	+	+	++
Multicellular plankton																			
Proales sp.	xx																		
Synchaeta sp.																			
Unidentified Rotifera							x								x			x	
Copepoda										x								x	
Ostracoda																		x	
Chaetopoda																			
Coelenterata										x									
Nauplii										x									
Megalops and Zoaea		x								x						x			
Veliger		x													x				
Trochophore							x												
Echinoderm larvae																			
Pisces larvae																			
HYDROGRAPHIC DATA																			
Temperature, °C.	29.9	28.4	28.6	27.5	28.0	27.8	26.5	27.0	27.5	29.0	27.7	28.0	27.8	27.5	28.0	27.8	27.0	26.8	26.4
Salinity, ‰	37.6	37.7	37.4	37.2	37.1	37.3	37.3	38.5	37.4	37.2	37.3	38.3	36.7	36.4	36.4	35.9	35.9	36.4	36.5
NO ₃ -NO ₂			0.4					0.5					0.4				1.3		
In. PO ₄ -P			0.3					0.3					0.1				1.4		
Tot. PO ₄ -P			0.6					0.3					0.4				1.8		
Carbohydrate			0.6					0.9					1.1				1.5		
Protein			0.1					0.2					0.1				0.8		

Table 8.--Relative abundance of plankton with associated hydrographic data

O C T O B E R 1956

Day	1	2	3	4	5	8	9	10	11	12	15	16	17	18	19	22	23	24	25	26	29	31
Time	0900	0820	0830	0825	0825	0900	0830	0830	0830	0830	0900	0830	0830	1005	0830	0900	0845	0900	0830	0830	1000	1045
BIOLOGICAL DATA																						
Unicellular plankton																						
Amphidinium spp.																						
Cochlodinium spp.																						
Gymnodinium breve																						
G. simplex																						
G. splendens	+		+		+																	
G. spp.	+	+	+	+	+	+	+									+	+++	+	+	+	+	+
Gyrodinium spirale																						
G. spp.																	+					
Torodinium spp.																						
Polykrikos spp.																						
Nematodinium spp.																						
Pouchetia spp.																						
Oxyrhis spp.																						
Ceratium furca	+			+										+		+	+	+				
C. fusus																						
C. tripos																						
Gonyaulax spp.																						
Peridiniopsis spp.			+	+																		
Peridinium depressum																						
P. digitale																						
P. divergens																						
P. spp.	+	+	+	+	+	+	+	++						+	++	+	+++	+	+	+	+	+
Dinophysis tripos																						
D. spp.																		+				
Exuvia spp.			+										+									
Prorocentrum sp.	+	+		+	+	+													+	+	+	+
Silicoflagellidae																						
Euglena spp.																						
Peranema spp.																						
Melosira spp.	+	+		+	+	+	+							+								+
Skeletonema spp.																						
Chaetoceros spp.	+			+	+	+	+															
Guinardia spp.			+														+					
Rhizolenia spp.																						
Thalassiothrix spp.																						
Navicula spp.																						
Pleurosigma spp.							+															
Nitzschia spp.											+					+					+	+

Table 8. cont'd

Day	1	2	3	4	5	8	9	10	11	12	15	16	17	18	19	22	23	24	25	26	29	31	
Time	0900	0820	0830	0825	0900	0830	0830	0830	0830	0830	0900	0830	0830	1005	0830	0900	0845	0900	0830	0830	1000	1045	
BIOLOGICAL DATA																							
Unicellular plankton																							
Grammatophora spp.																							
Unidentified phytoplankton																							
Strombidium sp.	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	
Unidentified																							
Halteriidae				+			+				+	+	+			+	+	+	+	+	+	+	
Tintinnopsis spp.						+	+				+	+	+			+	+	+	+	+	+	+	
Unidentified																							
Tintinnidae																							
Vorticella spp.		+	+			+	+		+	+		+	+			+			+		+		
Cothurnia sp.																							
Pleuronema sp.																							
Unidentified ciliates		+	+	+	+	+	+	++			+	+	+	+	++	+	+	+	+	+	+	+	
Multicellular plankton																							
Proales sp.															x								
Synchaeta sp.																							
Unidentified Rotifera						x																	
Copepoda	x	x	x			x	x			x	x	x	x			x		x		x	x	x	
Ostracoda																							
Chaetopoda																							
Coelenterata																							
Nauplii					x				x		x	x	x							x			
Megalops and Zoöea										x				x			x	x					
Veliger					x				x							x	x						
Trochophore																							
Echinoderm larvae											x	x											
Pisces larvae							x	x															
HYDROGRAPHIC DATA																							
Temperature, °C.	27.5	27.2	28.0	28.0	27.8	29.0	27.8	27.8	27.0	25.2	23.5	24.0	23.9	24.8	25.0	24.8	26.0	26.0	26.0	25.5	24.5	25.0	
Salinity, ‰	36.5	36.5	36.7	36.6	36.4	36.7	36.3	36.3	36.6	36.6	36.0	35.3	34.5	34.9	35.6	35.7	35.4	35.7	35.9	35.8	36.0	36.2	
NO ₃ -NO ₂				0.0					0.2					0.5					0.3				
In. PO ₄ -P				0.4					0.2					1.0					0.7				
Tot. PO ₄ -P				0.5					0.7					1.3					0.8				
Carbohydrate				1.5					2.0					1.8					1.5				
Protein				0.1					0.2					0.2					0.2				

Table 9.--Relative abundance of plankton with associated hydrographic data

N O V E M B E R 1956

Day	1	2	5	6	7	8	9	13	14	15	16	19	20	21	23	26	27	28	30
Time	0840	0820	0900	0830	0830	0830	0840	0825	0930	0910	0930	0845	0900	0845	0825	0900	0840	0840	0825
BIOLOGICAL DATA																			
Unicellular plankton																			
Amphidinium spp.																			
Cochlodinium spp.																			
Gymnodinium breve																			
G. simplex																			
G. splendens	+	+++	+	+++	+		+			+					+	+	+	+	+
Gyrodinium spirale																			
G. spp.										+									
Torodinium spp.	+						+												
Polykrikos spp.																			
Nematodinium spp.																			
Pouchetia spp.																			
Oxyrrhis spp.																			
Ceratium furca														+	+	+	+	+	
C. fusus																			
C. tripos																			
Gonyaulax spp.																			
Peridiniopsis spp.																			
Peridinium depressum														+	+				
P. digitale																			
P. divergens																			
P. spp.	+	+	+	+					+						+	+	+	+	+
Dinophysis tripos																			
D. spp.																			
Exuviella spp.																		+	
Prorocentrum sp.																			
Silicoflagellidae																			
Euglena spp.																			
Peranema spp.																			
Melosira spp.											+						+		
Skeletonema spp.																			
Chaetoceros spp.																			
Guinardia spp.		+	+									+							
Rhizosolenia spp.																			
Thalassiothrix spp.																			
Navicula spp.		+																	
Pleurosigma spp.																			
Nitzschia spp.						+					+								

Table 9. cont'd

Day	1	2	5	6	7	8	9	13	14	15	16	19	20	21	23	26	27	28	30
Time	0840	0820	0900	0830	0830	0830	0840	0825	0930	0910	0930	0845	0900	0845	0825	0900	0840	0840	0825
BIOLOGICAL DATA																			
Unicellular plankton																			
Grammatophora spp.																			
Unidentified phytoplankton	++	++	++	++	++	++	++	++	++	++	++	+	++	++	++	++	++	++	++
Stomidium sp.																			
Unidentified Halteriidae	+		+	+++			+	+	+						+	+		+	+
Tintinnopsis spp.	+	+	+	+				+	+						+				+
Unidentified Tintinnidae																			
Vorticella spp.	+	+	+	+				+							+			+	+
Cothurnia sp.																			
Pleuronema sp.																			
Unidentified ciliates	+	+	+				+	+	++	+	+	+	+	+	+	+	+	+	+
Multicellular plankton																			
Proales sp.																			
Synchaeta sp.																			
Unidentified Rotifera	x																		x
Copepoda										x									
Ostracoda																			
Chaetopoda																			
Coelenterata																			
Nauplii							x											x	
Megalops and Zoea	x	x	x							x					x	x	x	x	x
Veliger																			
Trochophore																			
Echinoderm larvae							x							x					
Pisces larvae																			
HYDROGRAPHIC DATA																			
Temperature, °C.	24.5	24.0	24.0	23.0	23.3	23.3	22.8	20.0	21.0	21.0	22.1	22.0	22.0	22.0	19.0	19.8	18.5	17.0	18.8
Salinity, ‰	36.3	36.3	35.8	35.6	38.6	38.6	38.5	35.7	35.6	35.8	35.8	36.1	36.3	36.2	36.2	36.3	36.1	36.0	36.2
NO ₃ -NO ₂	0.2						2.2			4.4					0.8				
In. PO ₄ -P	0.6						0.3			0.2					1.7				
Tot. PO ₄ -P	0.6						0.5			0.5					1.7				
Carbohydrate	0.4						0.5			1.6					2.4				
Protein	0.2						0.5			0.6									

Table 10.--Relative abundance of plankton with associated hydrographic data

D E C E M B E R 1956

Day	3	4	5	6	7	10	11	12	13	14	17	18	19	20	21	26	27	31
Time	0915	0945	0915	0900	0855	0915	0845	0825	0840	0825	0855	0925	0900	0955	0830	0830	0930	0850
BIOLOGICAL DATA																		
Unicellular plankton																		
Amphidinium spp.																		
Cochlodinium spp.																		+
Gymnodinium breve																		
G. simplex																		
G. splendens																		
G. spp.	+	+	+	+			+	+	+	+	+	+	+	+	+++	+	+	++
Gyrodinium spirale																		
G. spp.			+				+			+						+		++
Torodinium spp.																		
Polykrikos spp.																		
Nematodinium spp.																		
Pouchetia spp.																		
Oxyrrhis spp.																		
Ceratium furca		+	+				+	+	+	+	+	++						+
C. fusus																		
C. tripos																		
Gonyaulax spp.																		
Peridiniopsis spp.																		
Peridinium depressum																		
P. digitale																		
P. divergens																		
P. spp.	+	+		+	+		+	+	+	+	+	+++	+	+	+		+	++
Dinophysis tripos																		
D. spp.																		
Exuviella spp.										+			+	+		+		+
Prorocentrum sp.															+			+
Silicoflagellidae																		
Euglena spp.																		
Peranema spp.																		
Melosira spp.			+										+	+	+			
Skeletonema spp.																		
Chaetoceros spp.				+			+	+					+	+	+	+		+
Guinardia spp.													+					
Rhizosolenia spp.			+	+														
Thalassiothrix spp.																		
Navicula spp.																		
Pleurosigma spp.																		
Nitzschia spp.		+								+				+	+			

Table 10. cont'd

Day Time	3 0915	4 0945	5 0915	6 0900	7 0855	10 0915	11 0845	12 0825	13 0840	14 0825	17 0855	18 0925	19 0900	20 0955	21 0830	26 0930	27 0850	31 0850
BIOLOGICAL DATA																		
Unicellular plankton																		
Grammatophora spp.																		
Unidentified phytoplankton	++	++	++	++	++	++	++	++	+	+	++	++	++	++	++	++	++	++
Strombidium sp.																		
Unidentified	+					+	+											
Halteriidae						+	+	+	+++	+								
Tintinnopsis spp.	+	+				+	+	+										
Unidentified																		
Tintinnidae																		
Vorticella spp.				+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Cothurnia sp.																		
Pletronema sp.																		
Unidentified ciliates	+	+	++	++	++	+	+	+	+	+	+	+	+	+	+	+	+	++
Multicellular plankton																		
Proales sp.																		
Synchaeta sp.																		
Unidentified Rotifera	x	x				x	x	x										
Copepoda	x								x				x	x	x	x	x	x
Ostracoda																		
Chaetopoda																		
Coelenterata																		
Nauplii																		
Megalops and Zoaea				x								x						
Veliger																x	x	x
Trochophore																		
Echinoderm larvae																		
Pisces larvae	x													x				
HYDROGRAPHIC DATA																		
Temperature, °C.	18.0	18.0	18.2	17.7	19.0	19.8	20.0	20.0	21.0	21.4	22.0	22.4	22.0	22.0	21.5	19.5	18.2	17.5
Salinity, ‰	36.0	36.0	36.1	36.2	36.3	36.4	36.5	36.5	36.5	36.6	36.5	36.6	36.5	36.5	36.6	36.8	36.8	36.7
NO ₃ -NO ₂				0.4					1.3					1.2			1.6	
In. PO ₄ -P				0.3					2.6					0.2			0.8	
Tot. PO ₄ -P				1.6		1.9							0.7				0.9	
Carbohydrate				0.9					0.6				0.8				1.5	
Protein				0.6					0.2					1.3			1.0	

Table 11.--Relative abundance of plankton with associated hydrographic data

J A N U A R Y 1957

Day	1	2	3	4	7	8	9	10	11	14	15	16	17	18	21	22	23	24	25	28	29	30	31
Time	0855	1050	0835	0820	0940	0835	0835	0835	0845	0910	0855	0937	0925	0835	0900	0940	0920	0940	0830	0830	0825	0825	0840
BIOLOGICAL DATA																							
Unicellular plankton																							
Amphidinium spp.																							
Cochlodinium spp.	+							+++															
Gymnodinium breve		+																					
G. simplex																							
G. solens																							
G. spp.	+							+++															
Gyrodinium spirale																							
G. spp.	+	+																					
Torodinium spp.																							
Polytrikos spp.																							
Nematodinium spp.																							
Pouchetia spp.																							
Oxyrhis spp.																							
Ceratium furca	+	+																					
C. fusus																							
C. tripos																							
Gonyaulax spp.																							
Peridiniopsis spp.			+																				
Peridinium depressum																							
P. digitale																							
P. divergens																							
P. spp.	+																						
Dinophysis tripos																							
D. spp.																							
Exuviella spp.																							
Prorocentrum sp.																							
Silicoflagellidae																							
Euglena spp.																							
Peranema spp.																							
Melosira spp.	+	+	+	+	+																		
Skeletonema spp.																							
Chaetoceros spp.	+	+	+	+	+																		
Guinardia spp.																							
Rhizosolenia spp.																							
Thalassiothrix spp.																							
Navicula spp.																							
Pleurosigma spp.	+	+	+	+	+																		
Mitschia spp.																							

Table 11. cont'd

Day	1	2	3	4	7	8	9	10	11	14	15	16	17	18	21	22	23	24	25	28	29	30	31
Time	0855	1050	0835	0820	0940	0835	0835	0835	0845	0910	0855	0937	0925	0835	0900	0940	0920	0940	0830	0830	0825	0840	0840
BIOLOGICAL DATA																							
Unicellular plankton																							
Gramatophora spp.																							
Unidentified																							
phytoplankton																							
Strombidium sp.	++	+	++	++	++	++	++	++	++	++			++	++	++	++	+		+	+	++	++	
Unidentified																							
Halteriidae	+									+	+++		+	+	+								
Tintinnopsis spp.																							
Unidentified	+	+		+	+	+	+	+	+	+			+	+	+	+	+		+++	+	+	+	+
Tintinnidae																							
Vorticella spp.			+								++												
Gothurnia sp.	+		+		+		+	+	+	+			+	+	+	+	+	+	+	+	+	+	+
Pleuronema sp.																							
Unidentified ciliates																							
Multicellular plankton	+	+		+	+	+	+	+	+	+	+			+	+	+	+	++	+	+	+	+	+
Proales sp.																							
Synchaeta sp.																							
Unidentified Rotifera	x																						
Copepoda	x			x						x				x	x		x		x	x		x	x
Ostracoda																							
Chaetopoda																							
Coelenterata																							
Nauplii			x	x										x									
Megalops and Zoea	x			x	x				x	x				x	x	x	x		x	x		x	
Veliger														x									
Trochophore																							
Echinoderm larvae																							
Pisces larvae																							
HYDROGRAPHIC DATA																							
Temperature, °C.	18.0	19.5	17.5	17.0	19.5	19.5	19.0	19.5	20.0	20.0	19.0	21.0	22.0	17.5	18.0	19.0	19.5	20.0	19.5	21.0	21.4	19.5	21.9
Salinity, ‰	36.9	36.7	36.7	36.7	36.3	36.3	36.3	36.4	36.2	36.1	36.2	36.3	36.1	36.4	36.1	36.2	36.2	36.1	36.2	36.3	36.3	36.6	36.9
NO ₃ -NO ₂			0.4																				
In. PO ₄ -P								0.2										0.1				0.5	0.3
Tot. PO ₄ -P			1.0					0.3					1.0					0.1				0.1	0.2
Carbohydrate			1.0					0.5										0.7				0.4	0.6
Protein			1.5					2.2					0.9					0.8				1.2	0.6
			0.6					1.0					3.5					0.3				1.0	0.5

Table 12.-Relative abundance of plankton with associated hydrographic data

F E B R U A R Y 1957

Day Time	1 1015	4 0850	5 0925	6 0835	7 1010	8 0930	11 1015	12 0910	13 0850	14 0835	15 0830	18 0900	19 0835	20 0855	21 0835	25 0910	26 0825	27 0825	28 0845
BIOLOGICAL DATA																			
Unicellular plankton																			
Amphidinium spp.																			
Cochlodinium spp.												+							
Gymnodinium breve							+												
G. simplex																			
G. splendens																			
G. spp.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Gyrodinium spirale																			
G. spp.	+	+			+		+												
Torodinium spp.																			
Polykrikos spp.																			
Nematodinium spp.																			
Pouchetia spp.																			
Oxyrrhis spp.																			
Ceratium furca														+					
C. fusus																			
C. tripos																			
Gonyaulax spp.																			
Peridiniopsis spp.																			
Peridinium depressum																			
P. digitale																			
P. divergens																			
P. spp.	+	+	+	+			+		+	+	+				+	+	+	+	+
Dinophysis tripos																			
D. spp.																			
Exuviella spp.																			
Prorocentrum sp.													+						
Silicoflagellidae																			
Euglena spp.																			
Peranema spp.	+		+	+															
Melosira spp.	+	+	+	+															
Skeletonema spp.																			
Chaetoceros spp.	+	+	+	+	++	+	+		+				+	+	+	+	+	+	+
Guinardia spp.																			
Rhizosolenia spp.													+						
Thalassiothrix spp.																			
Navicula spp.												+							
Pleurosigma spp.																			

Table 12. cont'd

Day	1	4	5	6	7	8	11	12	13	14	15	18	19	20	21	25	26	27	28
Time	1015	0850	0925	0835	1010	0930	1015	0910	0850	0835	0830	0900	0835	0855	0835	0910	0825	0825	0845
BIOLOGICAL DATA																			
Unicellular plankton																			
Nitzschia spp.				+			+		+									+	
Grammatophora spp.																			
Unidentified phytoplankton	++	++	++	++	++	++	+	++	++	++	+	++	++		+	+	+	+	+
Strombidium sp.																			
Unidentified																			
Halteriidae			+				+						+						
Tintinnopsis spp.	+	+	+				+		+	+	+	+	+		+			+	
Unidentified																			
Tintinnidae																			
Vorticella spp.	+		+				+		+		+	+	+	+	+				
Cothurnia sp.																			
Pleuronema sp.																			
Unidentified ciliates	+	+	+	+		+	+	++	+	+	+			+	+	+	+	+	+
Multicellular plankton																			
Proales sp.																			
Synchaeta sp.																			
Unidentified Rotifera		x		x					x	x	x				x	x	x		
Copepoda				x						x									x
Ostracoda																			
Chaetopoda																			
Coelenterata																			
Nauplii								x											
Megalops and Zoea	x								x	x	x			x	x	x	x		x
Veliger										x									
Trochophore																			
Echinoderm larvae																			
Pisces larvae				x											x				
HYDROGRAPHIC DATA																			
Temperature, °C.	23.0	22.2	23.2	22.9	23.1	23.0	24.2	23.0	22.2	21.0	20.0	20.9	21.3	22.5	21.9	21.3	21.5	21.5	21.5
Salinity, ‰	36.2	36.2	36.3	36.4	36.4	36.3	36.3	36.6	36.5	36.3	36.3	36.4	35.9	36.4	36.0	36.1	36.2	35.8	35.7
NO ₃ -NO ₂					0.4					0.3					1.0				1.4
In. PO ₄ -P					0.1					0.6					0.6				1.0
Tot. PO ₄ -P					0.8					1.0					0.9				1.5
Carbohydrate					2.6					0.3					0.4				0.4
Protein					0.4					10.5					6.6				0.5

Table 13.--Relative abundance of plankton with associated hydrographic data

M A R C H 1957

Day Time	1	2	3	4	5	6	7	8	11	12	13	14	15	18	19	20	21	22	25	26	27	29
	0830	0920	0830	0840	0840	0840	0840	0845	0855	0820	0825	0825	0825	0910	0840	0940	0915	0900	0910	0840	0840	0835
BIOLOGICAL DATA																						
Unicellular plankton																						
Amphidinium spp.																						
Cochlodinium spp.																						
Gymnodinium breve																						
G. simplex																						
G. splendens																						
G. spp.	+																					
Gyrodinium spirale																						
G. spp.																						
Torodinium spp.																						
Polykrikos spp.																						
Nematodinium spp.																						
Pouchetia spp.																						
Oxyrhis spp.																						
Ceratium furca																						
C. fusus																						
C. tripos																						
Gonyaulax spp.																						
Peridiniopsis spp.																						
Peridinium depressum																						
P. digitale																						
P. divergens																						
P. spp.	+																					
Dinophysis tripos																						
D. spp.																						
Exuviella spp.																						
Prorocentrum sp.																						
Silicoflagellidae																						
Euglena spp.																						
Peranema spp.																						
Melosira spp.																						
Skeletonema spp.																						
Chaetoceros spp.																						
Guinardia spp.																						
Rhizosolenia spp.																						
Thalassiothrix spp.																						
Navicula spp.																						
Pleurosigma spp.																						
Nitzschia spp.																						

Table 13. cont'd

Day Time	1 0830	4 0920	5 0830	6 0840	7 0840	8 0845	11 0855	12 0820	13 0825	14 0825	15 0825	18 0910	19 0840	20 0940	21 0915	22 0900	25 0910	26 0840	27 0840	29 0835
BIOLOGICAL DATA																				
Unicellular plankton																				
Grammatophora spp.					+															
Unidentified phytoplankton	+	++		+	+	+	+	+	++				++			+	+	+	+	
Strombidium sp.																				
Unidentified Halteridae				+	+	+	+++	+	+	+	+			++		+	+	+	+	
Tintinnopsis spp.	+			+	+	+	+	+	+	+	+									
Unidentified Tintinnidae												+				+				
Vorticella spp.																				
Cothurnia sp.																				
Pleuronema sp.												+	+			+			+	+
Unidentified ciliates	+			+	+	+	+	+	+	+	+									
Multicellular plankton																				
Proales sp.																				
Synchaeta sp.																				
Unidentified Rotifera																x	x	x	x	
Copepoda				x	x	x	x	x							x					
Ostracoda																		x		
Chaetopoda																				
Coelenterata					x	x	x	x	x	x	x						x			
Nauplii	x	x		x	x	x	x	x	x	x	x	xx				x	x	x	x	
Megalops and Zoaea		x	x	x	x	x	x	x	x	x	x					x	x	x	x	
Veliger																				
Trochophore																				
Echinoderm larvae													x							
Pisces larvae																				
HYDROGRAPHIC DATA																				
Temperature, °C.	20.9	21.5	21.5	21.2	21.5	21.0	18.8	19.5	20.2	20.8	21.3	22.5	22.8	24.0	23.8	22.9	24.8	23.5	20.9	22.0
Salinity, ‰	35.7	35.8	35.5	35.2	35.3	35.1	34.9	35.0	35.3	35.0	35.4	34.8	34.8	34.8	34.8	35.0	35.0	34.8	34.4	34.6
NO ₃ -NO ₂						2.2									1.0					
In. PO ₄ -P						1.0									0.4					
Tot. PO ₄ -P						1.6									0.4					
Carbohydrate															6.5					
Protein						6.1														

Table 14.--Relative abundance of plankton with associated hydrographic data

A P R I L 1957

Day	1	2	3	4	5	8	9	10	11	12	15	16	17	18	19	22	23	24	25	26	29	30
Time	0925	0825	0930	0910	0835	0655	1020	0820	0830	1320	0850	0835	0830	0820	0835	0825	0820	0830	0830	0835	0930	0910
BIOLOGICAL DATA																						
Unicellular plankton																						
Amphidinium spp.																						
Cochlodinium spp.	+	+							+	+	+							+	+	+	+	+
Gymnodinium breve						+													+	+		
G. simplex						+																
G. splendens																						
G. spp.	+	+	++	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Gyrodinium spirale																						
G. spp.		+	++	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Torodinium spp.																						
Polykrikos spp.																						
Nematodinium spp.																						
Pouchetia spp.																						
Oxyrhis spp.																						
Ceratium furca	+	+																				
C. fusus																						
C. tripos																						
Gonyaulax spp.	+					+													+			
Peridiniopsis spp.	+	+																+	+			
Peridinium depressum																						
P. digitale																						
P. divergens																						
P. spp.	+	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Dinophysis tripos																						
D. spp.																						
Exuviella spp.																						
Proocentrum sp.	+					+		+			+						+	+	+		+	+
Silicoflagellidae	+		+			+									+			+	+			
Euglena spp.																						
Peranema spp.						+																
Melosira spp.					+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Skeletonema spp.																						
Chaetoceros spp.	+					+		+						+		+	+	+	+	+	+	+
Guinardia spp.						+	+	+														
Rhizolenia spp.			+			+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Thalassiothrix spp.																						
Navicula spp.	+																					
Pleurosigma spp.	+																					
Nitzschia spp.								+		+							+		+			+

Table 14. cont'd

Day	1	2	3	4	5	8	9	10	11	12	15	16	17	18	19	22	24	25	26	29	30
Time	0925	0825	0930	0910	0835	0855	1020	0820	0830	1320	0850	0835	0830	0820	0835	0825	0830	0830	0835	0930	0910
BIOLOGICAL DATA																					
Unicellular plankton																					
Grammatophora spp.						+		+					+								
Unidentified						++	++	+		+	+	++	++	++	+	+	+	++	+	+	++
phytoplankton																					
Strombidium sp.																					
Unidentified																					
Halteriidae						+	+	+			+	+	+	+	+	+	+		+	+	+
Tintinnopsis spp.																					
Unidentified																					
Tintinnidae																					
Vorticella spp.						+	+	+		+		+	+						+	+	+
Cothurnia sp.																					
Pleuronema sp.																					
Unidentified ciliates						+	+	+		+	+	+	+	+	+	+	+	+	+	+	+
Multicellular plankton																					
Proales sp.																					
Synchaeta sp.																					
Unidentified Rotifera						x	x	x		x	x	x	x	x	x	x	x	x	x	x	x
Copepoda						x	x														
Ostracoda																					
Chaetopoda																					
Coelenterata																					
Nauplii																					
Megalops and Zoea						x	x				x		x		x	x	x				
Veliger																					
Trochophore																					
Echinoderm larvae																					
Pisces larvae																					
HYDROGRAPHIC DATA																					
Temperature, °C.	21.0	22.2	23.5	23.4	24.5	25.5	26.4	25.6	26.0	27.6	25.0	24.4	24.0	24.4	24.5	24.5	24.3	25.0	25.5	25.2	25.1
Salinity, ‰	34.6	34.6	35.2	35.1	35.3	35.2	35.0	35.2	35.1	35.0	34.8	35.0	35.1	35.0	35.1	35.1	35.1	35.0	35.0	35.0	35.0
NO ₃ -NO ₂																					
In. PO ₄ -P																					
Tot. PO ₄ -P																					
Carbohydrate																					
Protein																					

Table 15. ---Relative abundance of plankton with associated hydrographic data

M A Y 1957

Day Time	1 0830	2 0840	3 0835	6 0915	7 0830	8 0825	9 0830	10 0830	13 0920	14 0825	15 0910	16 0750	17 0840	20 0900	21 0825	22 0900	23 0835	24 0840
BIOLOGICAL DATA																		
Unicellular plankton																		
Amphidinium spp.	+								+					+				
Cochlodinium spp.	+	+		+		+			+				+		+			
Gymnodinium breve		+																
G. simplex																		
G. splendens				+														
G. spp.	+	+	+	+	+	+	+	+	+	+			+	+	+	+	+	+
Cyrodinium spirale																		
G. spp.	+	+	+	+		+												
Torodinium spp.	+																	
Polykrikos spp.																		
Nematodinium spp.																		
Pouchetia spp.																		
Oxyrhis spp.																		
Ceratium furca														+				
C. fusus																		
C. tripos																		
Gonyaulax spp.																		
Peridiniopsis spp.									+									
Peridinium depressum																		
P. digitale																		
P. divergens																		
P. spp.	+	+		+	+	+	+	+	+	+			+	+	+	+	+	+
Dinophysis tripos																		
D. spp.																		
Exuviella spp.			+															
Proocentrum sp.	+				+													
Silicoflagellidae	+	+				+		+		+			+	+				
Euglena spp.							+						+	+	+		+	
Peranema spp.																		
Melosira spp.					+		+	+	+				+	+				
Skeletonema spp.																		
Chaetoceros spp.		+		+		+		+	+	+			+	+	+	+	+	+
Guinardia spp.																		
Rhizosolenia spp.																		
Thalassiothrix spp.																		
Navicula spp.																		
Pleurosigma spp.																		
Nitzschia spp.										+			+				+	

Table 15. cont'd

Day	1	2	3	6	7	8	9	10	13	14	15	16	17	20	21	22	23	24
Time	0830	0840	0835	0915	0830	0825	0830	0830	0920	0825	0910	0750	0840	0900	0825	0900	0835	0840
BIOLOGICAL DATA																		
Unicellular plankton																		
Gramatophora spp.																		
Unidentified phytoplankton	++	++		+	+	++	++	+	+	++			+	+	+	+	+	
Strombidium sp.					+													
Unidentified				+														
Halteridae																		
Tintinnopsis spp.		+								+								
Tintinnidae																		
Vorticella spp.	+	+		+	+	+	+	+		+			+	+	+	+	+	+
Cothurnia sp.																		
Pleuronema sp.																		
Unidentified ciliates	+	+	+	+	+	+	+	+		+			+	+	+	+	+	+
Multicellular plankton																		
Proales sp.																		
Synchaeta sp.																		
Unidentified Rotifera	x	x			x													
Copepoda	x			x	x			x	x					x	x	x	x	
Ostracoda																		
Chaetopoda																		
Coelenterata																		
Nauplii																		
Megalopa and Zoea	x	x		x	x	x	x	x					x	x				
Veliger	x				x													
Trochophore																		
Echinoderm larvae				x														
Pisces larvae							x											
HYDROGRAPHIC DATA																		
Temperature, °C.	25.6	25.9	26.3	25.5	25.1	25.0	24.5	24.8	26.8	27.1	27.2	26.7	27.5	28.8	29.5	29.8	29.0	29.0
Salinity, ‰	35.3	35.2	35.3	35.1	35.5	35.6	35.4	35.4	35.5	35.7	35.6	35.4	35.5	35.8	35.7	35.8	35.6	36.0
NO ₃ -NO ₂		1.0					0.2					0.8					0.2	
In. PO ₄ -P		0.8					0.6					0.3					0.3	
Tot. PO ₄ -P		1.0					17.4					2.4					1.0	
Carbohydrate		0.3					0.7					1.4					0.7	
Protein		0.9					0.5					0.6					0.6	

Table 16.--Relative abundance of plankton with associated hydrographic data

J U N E 1957

Day Time	3 0855	4 0850	5 0825	6 1000	7 0825	10 0910	11 0930	12 0849	13 0840	14 0840	17 0845	18 0815	19 0840	20 0905	21 0845	24 0920	25 1000	26 0955	27 0835	28 0830
BIOLOGICAL DATA																				
Unicellular plankton																				
Amphidinium spp.											+	+	+							
Cochlodinium spp.		+		+						+	+	+			+			+	+	
Gymnodinium breve											+									
G. simplex																				
G. splendens	+			+			+	+	+	+	+	+	+	+	+	+	+	+	++	+
G. spp.	+		+	+++																
Gyrodinium spirale																				
G. spp.							+			+										
Torodinium spp.			+				+			+										+
Polykrikos spp.				+							+									
Nematodinium spp.																				
Pouchetia spp.																				
Oxyrrhis spp.																				
Ceratium furca																				
C. fusus													+							
C. tripos																				
Gonyaulax spp.				+++						+	+	+	+							
Peridiniopsis spp.				+			+				+							+		+
Peridinium depressum																				
P. digitale															+					
P. divergens																				
P. spp.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Dinophysis tripos																				
D. spp.																				
Exuviella spp.								+						+						
Prorocentrum sp.	+			+	+	+					+	+					+			
Silicoflagellidae																				
Euglena spp.	+		+	+	+	+	+	+			+				+		+			
Peranema spp.																				
Melosira spp.	+		+					+				+	+					+		
Skeletonema spp.																				
Chaetoceros spp.	+	+				+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Guinardia spp.																				
Rhizosolenia spp.						+					+									
Thalassiothrix spp.																				
Navicula spp.												+								
Pleurosigma spp.												+	+							
Nitzschia spp.				+		+				+		+	+							

Table 16. cont'd

Day Time	3	4	5	6	7	10	11	12	13	14	17	18	19	20	21	24	25	26	27	28
BIOLOGICAL DATA																				
Unicellular plankton																				
Grammatophora spp.						+														
Unidentified phytoplankton	+	+	++	++	++	+	+	+	+	+	+	+	+	+	+	+	+	++	++	++
Strombidium sp.																				
Unidentified																				
Halteriidae		+	+	+													+			
Tintinnopsis spp.																				
Unidentified																				
Tintinnidae	+	+			+	+	+	+		+	+	+	+		+	+	+			
Vorticella spp.																				
Cothurnia sp.																				
Pleuronema sp.																				
Unidentified ciliates	+	+	+	+	+	+	+	+												
Multicellular plankton																				
Proales sp.																				
Synchaeta sp.																			x	
Unidentified Rotifera	x					x	x			x	x	x	x	x	x					
Copepoda			x																	
Ostracoda						xx	x													
Chaetopoda																				
Coelenterata								x												
Nauplii	x									x	x	x							x	
Megalops and Zoaea	x		x						x	x	x	x			x					
Veliger						x					x	x								
Trochophore																				
Echinoderm larvae																				
Pisces larvae																				
HYDROGRAPHIC DATA																				
Temperature, °C.	28.5	29.4	29.1	31.0	29.5	27.9	28.5	28.7	28.4	28.8	28.3	28.4	28.6	29.2	29.8	29.0	29.5	29.7	30.0	30.0
Salinity, ‰	35.8	36.0	35.9	36.0	35.7	36.3			33.1	36.9	36.7	37.0	36.8	36.9	36.7	36.8	36.3	36.7	36.2	36.1
NO ₃ -NO ₂				0.2					1.0		0.5			0.5					0.5	
In. PO ₄ -P				1.2					0.6		0.6			0.7					0.7	
Tot. PO ₄ -P				12.7					1.0		1.7			1.0					5.2	
Carbohydrate				1.2					1.2		1.4			0.5					0.3	
Protein				0.4					0.9		0.6			0.6					0.9	

JULY 1957

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Table 17. cont'd

Day	1	2	3	5	8	9	10	11	12	15	16	17	18	19	22	23	24	25	26	29	30	31
Time	0845	0915	0820	0845	0845	0945	0830	0835	0830	0915	0905	0830	1000	0915	1010	0825	0835	0835	0835	0720	0835	0900
BIOLOGICAL DATA																						
Unicellular plankton																						
Unidentified																						
Phytoplankton		+	++											++						+		
Strombidium sp.																						
Unidentified																						
Halteridae	+		+	+	+																	
Tintinnopsis spp.																						
Unidentified																						
Tintinnidae		+	+	+			+		+	+		+		+	+	+	+		+	+		+
Vorticella spp.		+																				
Cothurnia sp.																						
Pleuronema sp.	+	+	+	+																		
Unidentified ciliates																						
Multicellular plankton																						
Proales sp.																						
Synchaeta sp.																						
Unidentified Rotifera	x	x	x		x	x	x	x														
Copepoda	x	x				x																
Ostracoda																						
Chaetopoda																						
Coelenterata																						
Nauplii																						
Megalops and Zoaea	x																					
Veliger																						
Trochophore																						
Echinoderm larvae																						
Fishes larvae				x																		
HYDROGRAPHIC DATA																						
Temperature, °C.	30.5	30.0	30.0	30.0	30.0	30.2	30.5	30.1	30.0	30.4	30.8	30.3	30.3	29.9	31.0	30.0	30.0	30.0	30.5	30.7	31.5	30.5
Salinity, ‰	38.6	35.1	35.1	35.4	35.8	36.1	36.2	36.0	35.6	35.1	36.0	35.9	35.5	35.5	35.5	35.4	35.0	32.4	35.3	35.3	35.2	34.0
NO ₃ -NO ₂				1.1				0.5						0.3				0.4		1.2		
In. PO ₄ -P				0.5				0.4										1.1		0.7		
Tot. PO ₄ -P				1.6				0.8										1.7		0.8		
Carbohydrate				1.3				0.9					1.2					0.8		4.1		
Protein				0.9				8.0					0.9					1.0		0.6		

Table 18.--Relative abundance of plankton with associated hydrographic data

AUGUST 1957

Day	1	2	5	6	7	8	9	12	13	14	15	16	19	20	21	22	23	26	27	28
Time	0835	0900	0900	0850	0835	0840	0835	0910	0900	0900	0850	0820	1030	0840	0830	0840	0930	0940	0945	
BIOLOGICAL DATA																				
Unicellular plankton																				
Amphidinium spp.																				
Cochlodinium spp.																				
Gyrodinium breve																				
G. simplex																			++	
G. splendens					+	++	++	+	+	++								++	++	
G. spp.	+	++	+	+++																
Gyrodinium spirale																				
G. spp.	+																			
Torodinium spp.																				
Polykrikos spp.				+					+											
Nematodinium spp.																				
Pouchetia spp.																				
Oxyrrhis spp.																				
Ceratium furca		+	+	+			+													
C. fusus							+													
C. tripos			+																	
Gonyaulax spp.	+	+	+				+	+	+											
Peridiniopsis spp.		+	+	+																
Peridinium depressum				+																
P. digitale																				
P. divergens		+	+	+	+		+	+	+											
P. spp.	+	+	+	+	+		+	+	+	+++										
Dinophysis tripos																				
D. spp.	+			+++																
Exuviella spp.																				
Prorocentrum sp.	+		+++	+++	+++	+	+++													
Silicoflagellidae																				
Euglena spp.	+		+						+											
Peranema spp.							+		+											
Melosira spp.							+	+	+											
Skeletonema spp.																				
Chaetoceros spp.	+	+	+		+		+	+	+											
Guinardia spp.		+																	++	
Rhizosolenia spp.																				
Thalassiothrix spp.																				
Navicula spp.																				
Pleurosigma spp.																				
Nitzschia spp.							+	+	+								++			++

Table 18. cont'd

Day	1	2	5	6	7	8	9	12	13	14	15	16	19	20	21	22	23	26	27	28	
Time	0835	0900	0900	0850	0835	0840	0835	0910	0900	0900	0850	0820	1030	0840	0830	0840	0930	0940	0945		
BIOLOGICAL DATA																					
Unicellular plankton																					
Grammatophora spp.																					
Unidentified																					
phytoplankton			++																		
Strombidium sp.																					
Unidentified																					
Halteriidae								+													
Tintinnopsis spp.																					
Unidentified																					
Tintinnidae								+													
Vorticella spp.									+												
Cothurnia sp.																					
Pleuronema sp.																					
Unidentified ciliates																					
Multicellular plankton								+		+											
Proales sp.																					
Synchaeta sp.																					
Unidentified Rotifera																					
Copepoda		x					x	x		x											
Ostracoda								x													
Chaetopoda																					
Coelenterata																					
Nauplii			x																		
Megalops and Zoea		x		x																	
Veliger																					
Trochophore																					
Echinoderm larvae																					
Fishes larvae							x														
HYDROGRAPHIC DATA																					
Temperature, °C.	30.1	30.5	30.1	29.0	30.0	30.0	30.2	31.0	29.5	30.1	30.0	29.5	31.0	30.0	30.7	31.0	30.8	29.5	30.0	30.0	
Salinity, ‰	34.4	35.3	32.8	32.4	33.7	33.5	34.3	34.6	34.9	35.0	34.8	34.9	34.7	33.4	34.8	35.1	34.6	34.4	34.8	34.9	
NO ₃ -NO ₂																					
In. PO ₄ -P																					
Tot. PO ₄ -P																					
Carbohydrate																					
Protein																					









